

What is claimed is:

1. An apparatus for detecting a pointer within a region of interest comprising:
 - a first reflective element extending along a first side of said region of interest and reflecting light towards said region of interest;
 - a second reflective element extending along a second side of said region of interest and reflecting light towards said region of interest, said second side being joined to said first side to define a first corner;
 - a non-reflective region generally in the plane of at least one of said first and second reflective elements adjacent said first corner; and
 - at least one imaging device capturing images of said region of interest including reflections from said first and second reflective elements.
2. An apparatus according to claim 1 wherein said non-reflective region extends in the planes of both of said first and second reflective elements.
3. An apparatus according to claim 2 wherein said first reflective element extends only partially along said first side and wherein said second reflective element extends only partially along said second side thereby to define a gap in said first and second reflective elements at said first corner.
4. An apparatus according to claim 2 wherein said first reflective element extends generally along the length of said first side and wherein said second reflective element extends generally along the length of said second side, said first and second reflective elements being rendered non-reflective at said first corner thereby to define said non-reflective region.

5. An apparatus according to claim 1 wherein said non-reflective region extends only in the plane of one of said first and second reflective elements.
6. An apparatus according to claim 5 wherein said one reflective element extends only partially along the respective side of said region of interest thereby to define a gap in said one reflective element at said first corner.
7. An apparatus according to claim 5 wherein said one reflective element extends generally along the length of the respective side of said region of interest, said one reflective element being rendered non-reflective at said first corner thereby to define said non-reflective region.
8. An apparatus according to claim 1 wherein said non-reflective region is of a size to inhibit merging of a pointer with a double reflection of said pointer in a captured image.
9. An apparatus according to claim 8 wherein said size is a function of said region of interest and the thickness of said pointer.
10. An apparatus according to claim 9 wherein said first and second reflective elements extend along first and second sides of a generally rectangular touch surface.
11. An apparatus according to claim 10 wherein said region of interest includes an active area delineated by a margin extending about the periphery of said touch surface.

12. An apparatus according to claim 11 wherein said margin is of a size to inhibit merging of a pointer with one or more reflections of said pointer in a captured image.

13. An apparatus according to claim 12 wherein said non-reflective region extends in the planes of both of said first and second reflective elements.

14. An apparatus according to claim 13 wherein said first reflective element extends only partially along said first side and wherein said second reflective element extends only partially along said second side thereby to define a gap in said first and second reflective elements at said first corner.

15. An apparatus according to claim 13 wherein said first reflective element extends generally along the length of said first side and wherein said second reflective element extends generally along the length of said second side, said first and second reflective elements being rendered non-reflective at said first corner thereby to define said non-reflective region.

16. An apparatus according to claim 12 wherein said non-reflective region extends only in the plane of one of said first and second reflective elements.

17. An apparatus according to claim 16 wherein said one reflective element extends only partially along the respective side of said region of interest thereby to define a gap in said one reflective element at said first corner.

18. An apparatus according to claim 16 wherein said one reflective element extends generally along the length of the respective side of said region of interest, said one reflective element being rendered non-reflective at said first corner thereby to define said non-reflective region.

19. An apparatus according to claim 1 wherein at least one of said first and second reflective elements includes a plurality of reflective surfaces, said plurality of reflective surfaces including at least one pair of reflective surfaces arranged generally at right angles to one another and taking a V-configuration.

20. An apparatus according to claim 19 wherein said at least one first and second reflective element includes multiple pairs of reflective surfaces arranged generally at right angles to one another with each pair taking a V-configuration thereby to define a corrugated reflective surface.

21. An apparatus according to claim 20 wherein said at least one first and second reflective element is formed of material having a corrugated surface with a reflective coating thereon thereby to form said corrugated reflective surface.

22. An apparatus according to claim 21 wherein said material has a thickness defining opposed outer major surfaces, one of said major surfaces defining said corrugated surface and another of said major surfaces being generally planar.

23. An apparatus according to claim 22 wherein said at least one first and second element is arranged so that said corrugated reflective surface is nearest said region of interest.
24. An apparatus according to claim 22 wherein said material is light transmissive and wherein said at least one first and second reflective element is arranged so that said planar major surface is nearest said region of interest.
25. An apparatus according to claim 21 wherein both of said first and second reflective elements have corrugated reflective surfaces.
26. An apparatus according to claim 25 wherein said first and second reflective elements are formed of material having a corrugated surface with a reflective coating thereon thereby to form said corrugated reflective surfaces.
27. An apparatus according to claim 26 wherein said material has a thickness defining opposed outer major surfaces, one of said major surfaces defining said corrugated surface and another of said major surfaces being generally planar.
28. An apparatus according to claim 27 wherein said first and second reflective elements are arranged so that said corrugated reflective surfaces are nearest said region of interest.
29. An apparatus according to claim 27 wherein said material is light transmissive and wherein said first and second reflective elements are arranged so that said planar major surfaces are nearest said region of interest.

30. An apparatus according to claim 19 wherein said at least one of said first and second reflective elements includes a single pair of reflective surfaces.

31. An apparatus according to claim 30 wherein said at least one reflective element includes a pair of stacked trapezoidal pieces, each having a reflective surface.

32. An apparatus according to claim 30 wherein said trapezoidal pieces are formed from metal having a polished surface defining said reflective surface.

33. An apparatus according to claim 19 wherein each of said first and second reflective elements includes a single pair of reflective surfaces.

34. An apparatus according to claim 33 wherein each of said first and second reflective elements includes a pair of stacked trapezoidal pieces, each having a reflective surface.

35. An apparatus according to claim 34 wherein said trapezoidal pieces are formed from metal having a polished surface defining said reflective surface.

36. An apparatus according to claim 1 wherein at least one of said first and second reflective elements includes a generally planar reflective surface.

37. An apparatus according to claim 36 wherein said generally planar reflective surface is adjustable relative to the plane of said region of interest to

position said reflective surface so that light reflected thereby is directed towards said at least one imaging device.

38. An apparatus according to claim 1 wherein both of said first and second reflective elements includes a generally planar reflective surface.

39. An apparatus according to claim 38 wherein each of said planar reflective surfaces is adjustable relative to the plane of said region of interest to position said reflective surfaces so that light reflected thereby is directed towards said at least one imaging device.

40. An apparatus according to claim 39 wherein said first and second reflective surfaces are flat.

41. An apparatus according to claim 38 wherein said first and second reflective surfaces are slightly convex.

42. An apparatus according to claim 41 wherein said each of said first and second reflective surfaces has a radius of curvature generally equal to about 100 inches.

43. An apparatus according to claim 1 including a single imaging device.

44. An apparatus according to claim 43 wherein said imaging device looks across said region of interest from a second corner thereof diagonally opposite said first corner.

45. An apparatus according to claim 43 wherein said imaging device includes an image sensor having an active pixel sub-array, light reflected by said first and second reflective elements being directed towards said active pixel sub-array.

46. An apparatus for detecting a pointer within a region of interest comprising:

- a generally rectangular touch surface having an active sub-area defining said region of interest;

- a first reflective element extending along a first side of said touch surface and reflecting light towards said region of interest;

- a second reflective element extending along a second side of said touch surface and reflecting light towards said region of interest, said second side being joined to said first side at a first corner of said touch surface; and

- a detecting device detecting a pointer within said region of interest and reflections of said pointer appearing in said first and second reflective elements and determining the location of said pointer within said region of interest, said active sub-area being sized to inhibit said detecting device from detecting a pointer within said region of interest that merges with one or more of said reflections to an extent that said pointer and one or more reflections cannot be resolved.

47. An apparatus according to claim 46 wherein said active sub-area is delineated by a rectangular margin about the periphery of said touch surface.

48. An apparatus according to claim 47 further comprising a non-reflective region in the plane of at least one of said first and second reflective elements adjacent said first corner.

49. An apparatus according to claim 48 wherein said non-reflective region is sized to inhibit said detecting device from detecting a pointer within said region of interest that merges with a double reflection of said pointer appearing in one of said first and second reflective elements.

50. An apparatus according to claim 49 wherein said detecting device looks across said touch surface from a second corner thereof diagonally opposite said first corner.

51. An apparatus according to claim 50 wherein said detecting device includes an image sensor having an active pixel sub-array, light reflected by said first and second reflective elements being directed towards said active pixel sub-array.

52. An apparatus according to claim 51 wherein said non-reflective region is constituted by a gap in at least one of said first and second reflective elements adjacent said first corner.

53. An apparatus according to claim 51 wherein said non-reflective region is constituted by a portion of at least one of said first and second reflective elements rendered non-reflective adjacent said first corner to define said non-reflective region.

54. An apparatus according to claim 51 wherein said first and second reflective elements are configured to aim reflected light towards said active pixel sub-array.

55. An apparatus according to claim 54 wherein said first and second reflective elements are angled relative to said touch surface to aim reflected light towards said pixel sub-array.

56. An apparatus according to claim 54 wherein said first and second reflective elements having multiple reflective surfaces arranged relative to one another to aim reflected light towards said pixel sub-array.

57. An apparatus according to claim 49 further comprising illumination sources extending along the other two sides of said touch surface, said illumination sources directing light towards said first and second reflective elements.

58. An apparatus according to claim 57 further comprising a gap illumination source extending along said non-reflective region.

59. An apparatus according to claim 58 wherein said illumination sources and said gap illumination source are infrared illumination sources.

60. An apparatus according to claim 58 wherein said detecting device includes an image sensor having an active pixel sub-array, light reflected by said first and second reflective elements being directed towards said active pixel sub-array.

61. An apparatus according to claim 60 wherein said first and second reflective elements are configured to aim reflected light towards said active pixel sub-array.

62. An apparatus according to claim 61 wherein said first and second reflective elements are angled relative to said touch surface to aim reflected light towards said pixel sub-array.

63. An apparatus according to claim 61 wherein said first and second reflective elements having multiple reflective surfaces arranged relative to one another to aim reflected light towards said pixel sub-array.

64. An apparatus according to claim 57 further including an illumination source at said non-reflective region and directing light towards said detecting device.

65. An apparatus according to claim 49 wherein said pointer emits light at least when in contact with said touch surface and where the other two sides of said touch surface are non-reflective.

66. An apparatus according to claim 65 wherein said detecting device includes an image sensor having an active pixel sub-array, light reflected by said first and second reflective elements being directed towards said active pixel sub-array.

67. An apparatus according to claim 66 wherein said first and second reflective elements are configured to aim reflected light towards said active pixel sub-array.

68. An apparatus according to claim 67 wherein said first and second reflective elements are angled relative to said touch surface to aim reflected light towards said pixel sub-array.

69. An apparatus according to claim 67 wherein said first and second reflective elements having multiple reflective surfaces arranged relative to one another to aim reflected light towards said pixel sub-array.

70. An apparatus according to claim 50 further comprising:
at least one illumination source adjacent said detecting device and directing light across said region of interest; and
retro-reflective surfaces extending along the other two sides of said touch surface, said retro-reflective surfaces reflecting incident light impinging thereon back towards the region of interest.

71. An apparatus according to claim 70 wherein said detecting device includes an image sensor having an active pixel sub-array, light reflected by said first and second reflective elements being directed towards said active pixel sub-array.

72. An apparatus according to claim 71 wherein said first and second reflective elements are configured to aim reflected light towards said active pixel sub-array.

73. An apparatus according to claim 72 wherein said first and second reflective elements are angled relative to said touch surface to aim reflected light towards said pixel sub-array.

74. An apparatus according to claim 72 wherein said first and second reflective elements having multiple reflective surfaces arranged relative to one another to aim reflected light towards said pixel sub-array.

75. An apparatus for detecting a pointer within a region of interest comprising:

- a first reflective element extending along a first side of said region of interest and reflecting light towards said region of interest;

- a second reflective element extending along a second side of said region of interest and reflecting light towards said region of interest, said second side being joined to said first side to define a first corner; and

- at least one imaging device capturing images of said region of interest and reflections from said first and second reflective elements, said at least one imaging device having an active pixel sub-array and said first and second reflective elements being configured to aim reflected light towards said active pixel sub-array.

76. An apparatus according to claim 75 wherein said first and second reflective elements are angled relative to said region of interest to aim reflected light towards said pixel sub-array.

77. An apparatus according to claim 75 wherein said first and second reflective elements having multiple reflective surfaces arranged relative to one another to aim reflected light towards said pixel sub-array.

78. An apparatus according to claim 77 wherein said multiple reflective surfaces include at least one pair of reflective surfaces arranged generally at right angles to one another and taking a V-configuration.

79. An apparatus according to claim 77 wherein said multiple reflective surfaces include multiple pairs of reflective surfaces arranged generally at right angles to one another with each pair taking a V-configuration thereby to define a corrugated reflective surface.

80. An apparatus for detecting a pointer within a region of interest comprising:
a generally rectangular touch surface having an active sub-area defining said region of interest;
a detecting device looking across said sub-area from one corner of said touch surface; and
a first reflective element extending along one side of said touch surface and reflecting light towards said region of interest and towards said detecting device, wherein when a pointer is positioned within said region of interest, said detecting device sees said pointer and a reflection of said pointer appearing in said first reflective element, said active sub-area being sized to inhibit said detecting device from seeing a pointer within said region of interest that merges with said reflection to an extent that said pointer and reflection cannot be resolved.

81. An apparatus according to claim 80 wherein said detecting device includes an image sensor having an active pixel sub-array, light reflected by said first reflective element being directed towards said active pixel sub-array.

82. An apparatus according to claim 81 wherein said first reflective element is angled relative to said touch surface to aim reflected light towards said pixel sub-array.

83. An apparatus according to claim 80 further comprising at least one illumination source adjacent said detecting device, said illumination source directing light across said region of interest.

84. An apparatus according to claim 83 further comprising non-reflective material extending along the other sides of said touch surface and facing said detecting device.

85. An apparatus according to claim 84 wherein said active sub-area is delineated by an L-shaped margin about the periphery of said touch surface, said L-shaped margin having one arm extending generally the length of said first reflective element and a second arm extending towards said detecting device.

86. An apparatus for detecting a pointer within a region of interest comprising:

a first reflective element extending along a first side of said region of interest and reflecting light towards said region of interest;

non-reflective surfaces extending along the other sides of said region of interest; and

at least one imaging device capturing images of said region of interest including reflections from said first reflective element, said at least one imaging device having an active pixel sub-array and said first reflective element being configured to aim reflected light towards said active pixel sub-array.

87. An apparatus for detecting a pointer within a generally rectangular region of interest comprising:

a detecting device looking across said region of interest from one corner thereof;

a first reflective element extending along one side of said region of interest that is within the field of view of said detecting device and reflecting light towards said region of interest;

non-reflecting surfaces extending along the remaining sides of said region of interest; and

at least one illumination source for providing backlight illumination across said region of interest, wherein when a pointer is positioned within said region of interest, said detecting device sees said pointer directly and a reflection of said pointer in said first reflective surface.

88. An apparatus according to claim 87 wherein said detecting device calculates the location of said pointer within said region of interest via triangulation based on the pointer image and pointer reflection.

89. An apparatus according to claim 88 including a single illumination source disposed adjacent said one corner.